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THE ERADICATION OF BINDWEED,
OR WILD MORNING-GLORY.

BY

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., April 14, 1909.

SIR: I have the honor to transmit herewith a manuscript entitled "The Eradication of Bindweed, or Wild Morning-Glory," by Mr. H. R. Cox, Scientific Assistant in the Office of Farm Management, and recommend that it be published as a Farmers' Bulletin.

Several species of perennial bindweed have more or less weedy tendencies and in some sections of the country they constitute the most serious weed pest with which the farmer has to contend. Mr. Cox has made a careful study of these species, giving special attention to their root habits, and has found three practicable methods, which are given in the manuscript, by which these weeds may be exterminated.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

HON. JAMES WILSON,
Secretary of Agriculture.

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THE ERADICATION OF BINDWEED, OR WILD MORNING-GLORY.

INTRODUCTION.

The terms "bindweed" and "wild morning-glory" are rather indiscriminately applied to the various species of the genus of plants known by botanists as *Convolvulus* that are of importance as weeds. In certain limited sections other common names are used to refer to these species, such as gopher vine, pea vine, and wild sweet potato. By far the larger number of these plants are classified under the two species *Convolvulus sepium* and *C. arvensis*, the former a native of this country and the latter an introduction from Europe. There are a few other species, principally *Convolvulus sepium repens* and *C. californicus*, that occur as weeds in certain regions. The former is a variety of *Convolvulus sepium*, but is often referred to as *C. repens*.

In many parts of the country these species rank among the worst of all the weeds that trouble the farmer, and in some regions they are by far the worst. Being perennials, they propagate not only by their seeds, but also by their underground parts. It is the latter character especially that makes them such formidable enemies to the tiller of the soil. The common or cultivated morning-glory, with the large bell-shaped flowers of various colors, is sometimes found in fields where it has escaped from cultivation. This is an annual not difficult to control and should not be mistaken for a species of *Convolvulus*.

INJURIOUS EFFECTS OF BINDWEED.

For convenience in considering the injury caused by bindweed, the various types of farming may be divided into four general groups: (1) The growing of cultivated crops, which includes truck, small fruits, and commercial seeds; (2) small-grain growing; (3) orcharding and vineyarding; and (4) hay growing.

(1) It is in the first group that the wild morning-glory, or bindweed, gives the most trouble. It not only contends with the crops mentioned for the moisture and fertility of the soil, but climbs and twines around them, dragging them to the ground. Unless thorough and frequent cultivation is given from the first the bindweed will get such a start that subsequent tillage will drag down much of the top growth of the crop. Some crops will grow better than others in a bindweed field. Corn, for instance, if it secures a good start, will make a fairly good growth in spite of the weed. But such low-growing crops as potatoes, strawberries, and onions are overpowered and smothered unless most persistent cultivation and expensive hand hoeing are pursued.

It is impossible to eradicate this weed in cultivated crops with the implements commonly used, as many of the stems slip through the teeth or shovels without being much disturbed. In fact, anything short of good cultivation is a benefit to the bindweed, since insufficient cultivation merely breaks it up and distributes it over the field. After the crop is laid by, the weed grows undisturbed and often becomes a dense mat of vines on land that had been given fairly good cultivation earlier in the season. In many cases this weed has caused a discontinuance of this type of farming.

(2) As a rule, bindweed does not do much damage to small grain. There are, however, regions especially favorable to the growth of this weed where these crops are greatly injured. Besides robbing the soil of moisture, this weed binds and drags down the tops; it also makes harvesting difficult by clogging the knife of the binder.

The time of sowing has much to do with the amount of growth made by the weed. If grain is sown in the fall or early spring it will have made a fair growth before the wild morning-glory gets under way. The height of the stand is also a factor, as a tall growth will produce a greater shading effect than a short one. In western Kansas, where a low-stemmed type of wheat is grown, the bindweed has worked in badly, there being entire quarter sections which are thickly set with it. In those localities, however, where small grain occurs in a short rotation with well-cultivated corn and clover the weed does not do much damage to the grain.

(3) In orchard and vineyard lands, and this applies especially to those of the West, the wild morning-glory is of still less consequence. The use of the weed cutter or weed knife in orchard cultivation, as is the common practice in California, has greatly lessened the weed problem. Furthermore, the shading effect of the trees does much to keep the weed under control.

Those ranchers who give normal cultivation to their orchards do not worry much about this weed. To a certain extent they consider

it an advantage, since it springs up after cultivation stops and makes a good winter cover crop. But in cases where orchards receive insufficient cultivation the weed is a more or less serious injury to the trees, especially to young trees. Bindweed is a greater nuisance in vineyards than in orchards on account of the lack of shade and the greater difficulty in the use of the weed knife.

(4) The presence of wild morning-glory vines, although it injures the market value of hay, probably does not materially affect its feeding value. In the case of alfalfa, clover, cowpeas, and other hay crops that produce a shading effect, the bindweed is a negligible factor.

DISTRIBUTION.

Bindweed is found in most sections of the United States and southern Canada. Although it sometimes occurs on upland soils, it is found more often on deep bottom lands and on rich prairie soils. The weed is therefore at its worst on the most productive and most valuable land. It grows on the valley lands of New England, the Middle Atlantic States, and to a lesser extent in the Southern States; also, in the entire area of the Corn Belt and on the valley lands of the West. East of the one hundredth meridian the native hedge bindweed is the most common species, although the field bindweed is also widely scattered. West of that point the field bindweed is probably the most common species, the hedge bindweed occurring to some extent in California. The trailing form with downy leaves (*Convolvulus sepium repens*) has been reported as a weed from central-western Kansas only, in which locality it has become a most serious menace to the wheat growers. The fourth species of importance as a weed is the California form (*Convolvulus californicus*), which occurs only in central-western California, for the most part on hill lands.

Although bindweed usually occurs distributed generally over the land, it is sometimes confined to well-defined patches. It is not an uncommon sight to see one or more of these patches in a field, each of a more or less circular outline, indicating that the weed is spreading by its underground growth from a central point of infection. Where the land has been infested for some time and careless cultivation has been given, the weed becomes scattered over the land.

Another interesting point which has been disclosed by a study of this weed under field conditions is that the underground parts rarely penetrate the subsoil. This depends, however, somewhat on its character, since a subsoil that resembles the surface soil in texture and fertility admits the roots and rootstocks to a certain extent. In all cases where the subsoil is of an impervious or clayey nature the underground parts of the plant are confined to the soil stratum en-

tirely. Figure 1 represents the rootstocks going no deeper than 6 inches in a clay soil of medium depth on the Arlington Experimental



FIG. 1.—Rootstocks of bindweed growing shallowly in a clay soil of medium depth.

Farm of the Department of Agriculture. The bottom of the drawing marks approximately the subsoil line.

DESCRIPTION.

CHARACTERS OF THE WEED ABOVE GROUND.

Convolvulus sepium L. (fig. 2) has a long, twining stem, with triangular, halberd-shaped leaves, that is, arrow shaped, with the basal lobes pointing outward. The flowers are funnelform, with much the same appearance as those of the cultivated morning-glory, but are always white or rose colored. The base of the flower is inclosed in bracts about three-fourths inch in length. The most widely accepted common name for this plant is "hedge bindweed."

The stem of *Convolvulus arvensis* L. (fig. 3) is either trailing or twining and the leaves are somewhat egg shaped, with the lobes at the bases pointed and projecting. The flowers are funnelform, white or tinged with red, but are not nearly as large as those of *Convolvulus sepium*. The bracts surrounding the base of the flowers are small. The common name of widest acceptance is "field bindweed."

Convolvulus sepium repens Gray is much like the hedge bindweed except that the stem and leaves are more or less downy, and the stems are trailing rather than twining.

The California form of bindweed (*Convolvulus californicus* Choisy) has stems from 1 to 15 inches in length. When short they

are erect; when long, trailing. The leaves vary from oval to triangular in outline and are about an inch long. The bracts are of medium size and the flowers are of about the same size and shape as those of the hedge bindweed, white or creamy, with purplish exterior.

UNDERGROUND CHARACTERS OF THE WEED.

A study of the eradication of any perennial weed should begin with a consideration of its underground parts. When the character of its underground growth is determined the next step is to devise a method of eradication based on its habits. The underground parts of the various species of *Convolvulus* are divided into two groups, which are illustrated by the hedge bindweed on the one hand and by the field variety on the other.

The hedge bindweed may start growth in the spring from near the top of the rootstock sent to the surface during the preceding year, or the top growth may come from any part of the preceding year's underground growth. This underground stem forms buds, from which new rootstocks grow.

Furthermore, new rootstocks may grow from any of the buds along the old rootstock. Figure 4 shows new rootstocks put forth from both the new underground stem or shoot and the old rootstock. This fact indicates that an individual rootstock or piece of a rootstock may retain its vitality for two or more years if left undisturbed.

The field bindweed is propagated by roots instead of rootstocks. These roots extend in a more or less horizontal direction from several inches to several feet below the surface. At any point along the root

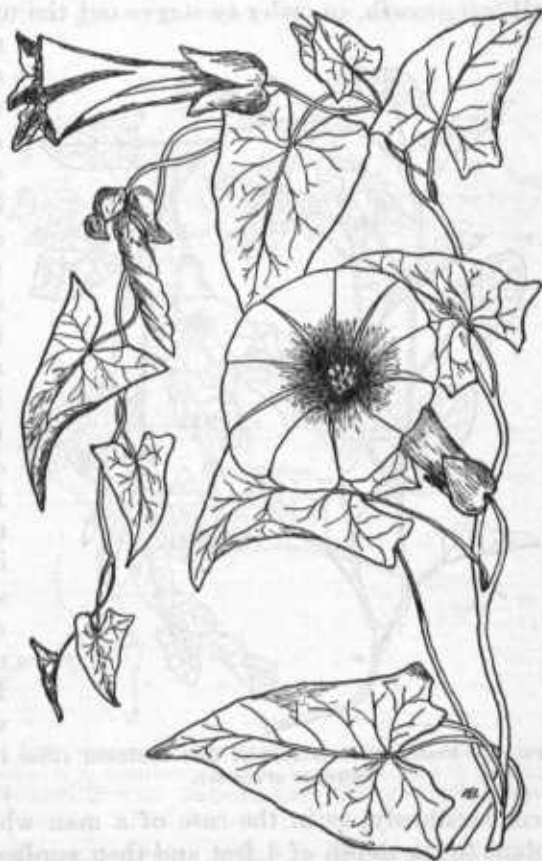


FIG. 2.—Branch with flowers of hedge bindweed (*Convolvulus sepium*).

an adventitious bud may form, from which a branch root grows or a root shoot is sent to the surface. These root shoots form buds, from which other root shoots grow to the surface, thus giving the impression that the plant propagates by rootstocks.

METHODS OF ERADICATION.

From the facts stated it is evident that the only successful methods for the eradication of bindweed must be based on the suppression of all top growth, in order to starve out the underground parts, except,

of course, those methods, at present of little value, which have for their object the direct killing of the roots or rootstocks by the application of chemicals. A great many farmers are looking for some easy method of killing the bindweed, and in the mean time are letting it cover the fields and festoon the trees of the orchard. They are looking for some magic "remedy" that will completely eradicate the weed with a small amount of exertion on their part. It must be understood that such a formidable enemy as this weed requires heroic

treatment. Other farmers have gone at the problem

heedlessly, as in the case of a man who followed the root of a plant to the depth of 4 feet and then applied a large quantity of salt in the hole.

Various methods have been tried to keep down the top growth, and hence starve out the underground parts. There are three methods that have given satisfactory results, namely, clean cultivation, alfalfa growing, and hog pasturing. There are other methods that have been tried, but not with a large measure of success. These include the placing of building paper, beet pulp, apple pomace, straw, or manure on the ground to smother the weed growth, and also the application of chemicals. Conditions in irrigated regions are complicated by the



FIG. 3.—Branch with flowers of field bindweed (*Convolvulus arvensis*).

fact that bindweed is often allowed to grow along irrigation ditches, the water in which distributes the seed. The water of streams, especially at flood times, is also a factor in distributing the seeds and roots to other land.

CLEAN CULTIVATION.

Bindweed can be eradicated by clean cultivation if thorough and persistent. The ease requires going over the land once every week or ten days during the entire growing season of the weed, which is

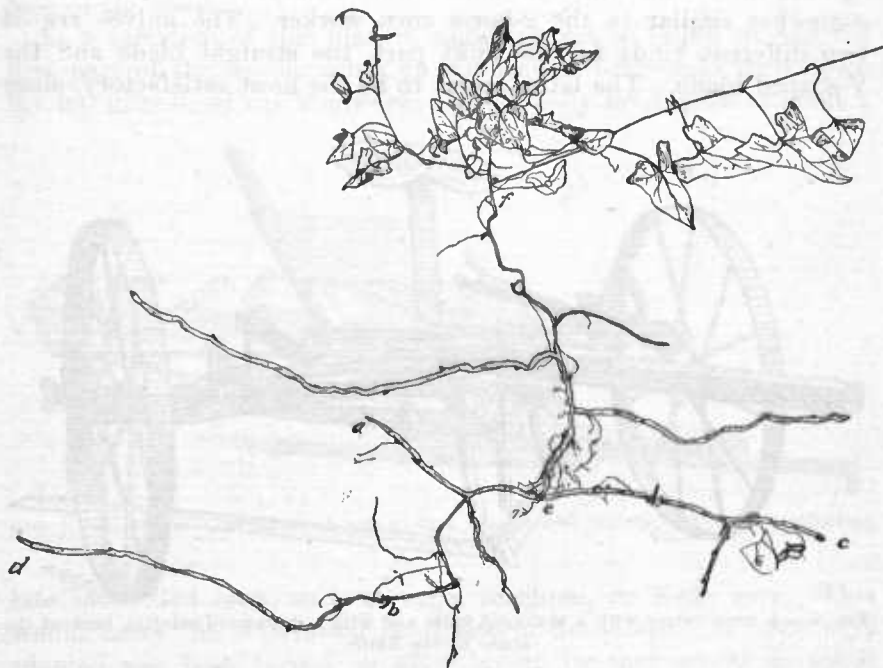


FIG. 4.—Underground parts of hedge bindweed. The piece of rootstock *a*, *b*, *c*, is of a preceding year's growth. The stem *e*, *f*, together with the rootstocks from it and the section *b*, *d*, are of the present season's growth. Drawing made from photograph taken in October.

between the spring and fall frosts. Two years of this treatment will accomplish the result in most cases, and it is probable that one year will suffice where the plant does not root deeply. The difficulty is that many farmers will not cultivate as thoroughly as is necessary. Even a small top growth is enough to form some new underground growth and rejuvenate the old roots or rootstocks, thereby carrying the plant over to the next season. Cultivation has the further advantage of inducing a rapid germination of all seeds of the weed which are in the soil, the young seedlings being promptly destroyed by the subsequent tillage.

Conditions in orchard lands are such as to offer a favorable opportunity to get rid of this weed or at least to so reduce it that it does not do much damage. Many California orchardists use a type of implement that has been found to be very successful in the control of weeds—the weed knife. This is made in various patterns, the principal feature being a knife which is run under the surface of the soil at a depth of from 3 to 6 inches, thereby cutting off the tops of all weeds. Fortunately, the underground parts of the bindweed are quite fragile, and hence this implement does very effective work against this weed. Most of these weed knives are attached to a rig somewhat similar to the 2-horse corn worker. The knives are of two different kinds for the most part, the straight blade and the V-shaped blade. The latter seems to be the most satisfactory, since

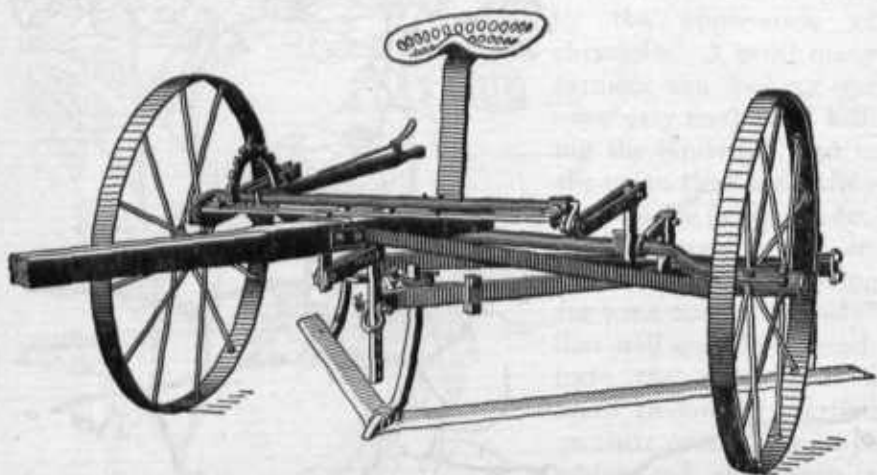


FIG. 5.—A weed cutter with a V-shaped knife and with a downward-pointing beak at the angle of the knife.

in soils in which a sod or a cover crop has been plowed under the straight blade is apt to clog. These knives make cuts of different widths, varying from 3 to 6 feet. In soils that are cloddy or of a rather stiff nature it is necessary to attach a sharp beak, pointing downward, at the angle of the V, so that the knife will not be forced upward. Figure 5 shows such an implement which has proved quite satisfactory.

Another implement, shown in figure 6, is beginning to be used. It consists of a beam resting on the ground, varying in width from 8 to 12 feet, with a series of knives below, all inclined inward. Its draft is light, it makes a wide cut, it can be worked close to the trees, and is comparatively inexpensive. It is rather difficult to use, however, in cloddy soils.

It is possible, of course, to eradicate the bindweed in bare fallow land by the use of the implements mentioned or the disk if the farmer is willing to do this for a year or more without any return. It is also practicable to give sufficient cultivation with an intertilled crop to get rid of the weed. It is necessary in that case to supplement the cultivator with the hoe after the crop is laid by. This is rather tedious, but it would pay in many cases. Such implements as the "heel" scrape of the South or the "gopher" cutter of the Corn Belt are the best to use in the cultivation of the crop. These perform about the same function as the weed knife in cutting off the tops of the weeds.

As a variation of this plan it might be best to fallow during the first part of the season, using an implement that would keep down the top growth of the bindweed; then in July or August to plant a

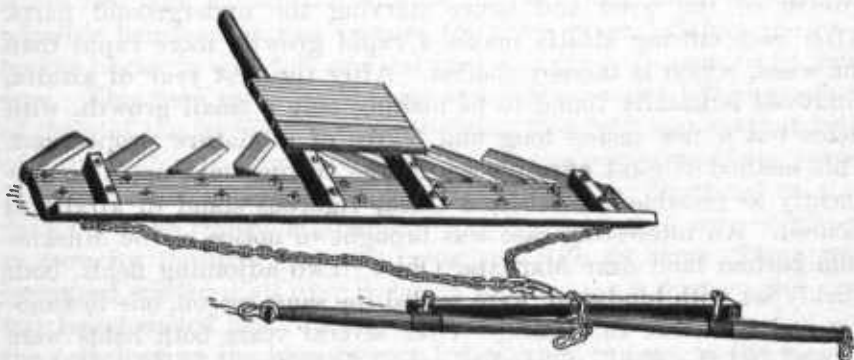


FIG. 6.—A second type of weed cutter that has proved satisfactory in exterminating bindweed.

late intertilled crop, such as rape, sorghum, or Kafir corn. This would carry the cultivation until late in the season. If rape were planted and hogs turned on after laying by they would do much toward killing the weed. The bindweed ceases to grow after frost.

Another plan that has been successfully employed in California is to alternate fallow with a smothering crop. Such a crop is sown in the fall or early winter, so that by the time the weed begins its growth in the spring the crop has made enough headway to shade the land and exert a smothering effect on the weed. As soon as the crop is off in early summer the land is plowed and fallowed the rest of the season. A repetition of this plan for several years will greatly reduce the weed growth, although no cases have been found in which it has been entirely eradicated. Such crops as peas or horse beans are adapted to this scheme, and in the seed-growing districts sweet peas or mustard.

It is important to note that where the bindweed occurs in patches these should be marked off and given special attention. It is much cheaper to cultivate thoroughly a part of the field than the whole field. Clean cultivation is the most available method of eradicating the bindweed in many cases, and if entered into with a full knowledge of conditions it can be done with less labor and expense than is commonly supposed.

GROWING ALFALFA HAY.

Numerous cases have been found in which bindweed was greatly lessened or entirely eliminated by seeding an infested field to alfalfa for hay. This is effected by two factors, namely, the frequent cutting and the smothering effect of the crop. The frequent cutting serves about the same purpose as clean cultivation in keeping down the top growth of the weed and hence starving the underground parts. After each cutting alfalfa makes a rapid growth, more rapid than the weed, which is thereby shaded. After the first year of alfalfa, bindweed is usually found to be making only a small growth, with stems but a few inches long and leaves of miniature proportions. This method is most effective where the cuttings are made as frequently as possible and where a thick, vigorous stand of alfalfa is secured. An interesting case was brought to notice in the Muskingum bottom land near Marietta, Ohio. Two adjoining fields, both thickly set with bindweed, were seeded the same season, one to timothy and the other to alfalfa. After several years both fields were plowed and the whole planted to corn. It was very apparent where the alfalfa had been by the absence of bindweed, while the other piece of land still contained the weed.

Alfalfa growing as a method of bindweed eradication is applicable, of course, only where it is possible and desirable to grow alfalfa. But where conditions are favorable there is little doubt that two or three years of alfalfa will greatly reduce or sometimes entirely destroy the weed in the most thickly infested fields. By following this crop with a cultivated crop and carefully keeping down the weed growth that still persists the land can be finally cleaned.

PASTURING WITH HOGS.

Hog pasturing as a method of eradicating bindweed is based on the fact that hogs are very fond of the roots and rootstocks of this plant, which taste much like the sweet potato. Hence, if hogs do not have their noses rung or slit they will root to a considerable depth to obtain the underground parts. It is common to see hog pastures which have contained bindweed with the surfaces torn up and rough,

showing where the hogs have been at work, even though there is an abundance of forage for them. It is the universal testimony of the best farmers that pasturing with hogs will reduce the prevalence of the weed, although but few have given the plan a thorough trial. This method can be employed in two ways: (1) By turning the hogs on ordinary pasture and (2) by plowing the land and then turning on the hogs.

The first way probably requires a longer time to accomplish the result than the second. Hogs not only eat the tops closely, but they also root for the underground parts in pasture land. Mr. George Wiggins, of Lodge, Ill., has practiced this method for a number of years with success. He leaves the land in pasture for about three years, with a sufficient number of hogs on it to keep it closely pastured. In the summer of 1908 he showed the writer a field of corn which had been in corn and oats for the past three years, previous to which it had been in hog pasture for three years. Before the pasturing began it was full of bindweed, but there is none to be seen now. This field contains 30 acres and carried about 100 hogs, most of them of the spring brood. Adjoining this field was another field of corn, which had been in hog pasture the preceding three years. Before pasturing there had been a great deal of bindweed in this field, but there is none at present. Another field of 14 acres in clover pasture for the first year was being run with 60 hogs. There was bindweed scattered all over it, but it was making a poor growth and was being rooted out. In breaking a pasture Mr. Wiggins plows in the fall, leaving the hogs to root for all they can get in the plowed land. In the spring he plows again and plants corn. He does not ring his hogs, of course. Many other farmers have noticed that running hogs on grass pasture greatly diminishes the quantity of the weed.

With the second plan, the land is first plowed. This accomplishes several purposes; it loosens the soil so that hogs can root more easily; it turns under all other vegetation, thereby limiting the hogs to the bindweed only; and it turns many of the roots and rootstocks to the surface, where the hogs can see them and get them to better advantage. It is often best to plow the infested land more than once during the season. Only a small quantity of feed should be given the hogs in order that they may be forced to devote their attention to the bindweed. Although hogs may not make quite as good gains on this diet as on others, many farmers have reported that their hogs have done very well under such treatment. It is a good plan to have more hogs than are necessary to keep down the bindweed growth and to move them to other pastures at times.

A typical case of the employment of this method of eradication is that of Mr. Price N. Jones, of Towanda, Ill. Mr. Jones had a small patch of about a quarter of an acre of blackberries in which the bindweed became so thick that the bushes ceased to make much growth. He cut them down in September and plowed the land soon afterwards. The fence was then opened to admit some 15 hogs from an adjoining grass lot of 3 acres. The hogs were not on a full feed of corn and at once began rooting vigorously at the bindweed. During the fall, winter, and spring they rooted the field over thoroughly, and practically no bindweed has come up since.

The use of this method means that the land must be given up to this treatment for at least a year. Just how long it requires to completely eradicate the weed it is difficult to say, since it depends upon conditions, especially on how deep the underground parts go. Where the weed does not root deeply, a year is probably enough. Where it does root deeply, two years might be required. It is best to put the land to a cultivated crop following hog pasturing in order to kill the scattering growth that may persist.

As a suggestion, this method of hog pasturing might be used for short periods in a regular rotation without interfering in any way with the rotation. For instance, Mr. Jones turned hogs on oats stubble one summer, the field being seeded to clover, the hogs being kept on during the fall and winter and rooting up the soil a good deal, but not enough to damage the clover seriously. He plowed this field the following fall and put the hogs on again till spring, and then planted corn. He states that the bindweed is very materially reduced.

There are certain features about hog pasturing that limit its use as a means of weed control. The water supply is one of them. It is, of course, much more convenient to have water in the field than to transport it. Most farmers have their hog lots close to the farm buildings, which is more convenient than having them at a distance. Again, it is necessary to make the fences "hog tight," if they are not already so, which involves labor and expense. This, however, may be done cheaply by putting up a temporary hog fence, which, after the hogs are taken off, is to be removed and used again. It is therefore difficult to say whether or not a particular farmer should use hog pasturing as a means of exterminating the bindweed. If it fits into his scheme of farming and the difficulties are not too great, it would be well to employ it. Each case is a problem in itself. Where the conditions are favorable hogs are likely to prove a most effective means of getting rid of this weed.

OTHER METHODS OF ERADICATION.

Pasturing with sheep.—Pasturing with sheep has been reported to have killed the bindweed, but the evidence on this point is meager. It is possible that if a grass pasture is run with a sufficient number of sheep for a long enough time the weed will disappear. Grass can stand close pasturing better than most weeds, if they are grazed equally close, but it remains to be demonstrated whether or not this plan will completely eradicate the bindweed, and, if so, how many years it will require. In parts of the far West, where grass becomes brown and dry during the summer season, sheep are reported to have killed the weed, for the reason that it is often the only vegetation that remains green in the pasture at that season. There is no doubt, however, that sheep are of assistance to hogs in pasturing for the eradication of bindweed. They eat the tops close to the ground, which checks the growth of the weed.

Use of smothering crops.—By smothering crops are meant those crops, other than alfalfa, that exert a shading effect on weed growth, such as cowpeas, soy beans, millet, sorghum, and buckwheat. No extensive trials of these crops as a means of controlling the bindweed have been made, so it is impossible to define at the present time their adaptability for this purpose. With a continuous succession of such crops, and when thick stands are secured, it is probable that in time the weeds would be much reduced. At best, however, these crops are hardly as effective as alfalfa.

Use of artificial smothering material.—Building paper, manure, beet pulp, apple pomace, straw, and other litter have been much used in the attempt to smother out bindweed growing in patches. It is necessary to apply such material, except building paper, quite thickly on the ground to prevent the weed from pushing through, as it has been known to go through a thickness of 2 feet. This method is therefore rather expensive and is not applicable to any but small areas. Indeed in most cases it is misdirected energy, which could be employed more profitably in some other direction. The use of building paper has been tried with some success on small areas where the laps were carefully weighted down with soil to exclude all light. Such paper can be purchased at from \$2.25 to \$4 per 1,000 square feet, depending on the thickness of the ply, which is at the rate of \$97 to \$172 per acre. This cost makes the method impracticable except for very small areas. The thin ply would be about as satisfactory as the thick. If the bindweed were inclined to grow through at the laps it would be necessary to lay another thickness of the paper, the laps running at an angle to those underneath. The paper would probably have to be renewed each season, and it

would take as long to subdue the weed as it would by means of clean cultivation.

Use of chemicals.—Many farmers have applied salt, kerosene, lime, and other substances for the purpose of killing the underground parts of the bindweed. One difficulty with this method is that on account of the habits of the roots and rootstocks of bindweed such applications must be spread all over the infested area, which makes the cost so high that these materials can be used profitably in only a limited number of cases. Another difficulty is that a quantity sufficient to kill the weeds will also injure the land to such an extent that no crops can be grown for several years subsequently. Crude salt is probably the cheapest material for the purpose.

Tests have been made by agricultural experiment stations and farmers to kill bindweed by repeated applications of salt, iron sulphate, arsenite of soda, and other chemicals in solution as sprays. Such experiments have failed to show that this method is of any value. Although the tops are killed to the ground new plants immediately spring up. The sprayings must be given once every few days during the growing season for at least two years before the weed finally ceases to grow. The result can undoubtedly be accomplished in less time and with less expense by some other method.

SUMMARY.

(1) The names bindweed and wild morning-glory refer to the several species of the genus of plants known as *Convolvulus* that are considered weeds, including primarily hedge bindweed (*Convolvulus sepium*) and field bindweed (*C. arvensis*), two other species, *Convolvulus sepium repens* and *C. californicus*, being of secondary importance.

(2) These weeds are a very serious detriment to the growing of crops in many regions. They are especially important in cultivated crops, are sometimes of a serious nature in small grain and orchards, but do no serious damage to forage crops.

(3) Bindweed usually occurs on bottom lands and rich prairie soils. It is sometimes found growing in patches, but it is more common to find it distributed more or less generally over the field. Its depth of rooting is governed largely by the nature of the soil.

(4) The underground parts are of two forms, exemplified by hedge bindweed and field bindweed; the first is propagated by rootstocks and the second by roots. The nature of the underground parts of both of these forms indicates that the top growth must be kept down, thereby starving out the roots and rootstocks, in order to eradicate the weed.

(5) Several methods for accomplishing this eradication have been successful. Clean cultivation is one of the best in many cases. It is essential to employ such implements as will keep down the top growth successfully. Where the weed occurs in patches these should be marked off and given special attention.

(6) The bindweed may be greatly reduced or entirely destroyed by seeding the land to alfalfa. The frequent cutting and the shading effect of this crop are the determining factors. Alfalfa should be followed by a cultivated crop to complete the work of destruction.

(7) Pasturing with hogs has been successful in killing bindweed, since hogs are quite fond of the underground parts. This method can be used with both ordinary pasture and fallow land. Results can probably be obtained in less time in the latter case.

(8) Several other methods have been tried, but they are for the most part of doubtful value. The use of chemicals has not been attended with much success in the control of this weed.